The effect of milk feeding frequency on the performance of Dexter x Holstein calves from birth to weaning

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Abstract
Calf rearing is a demanding task which requires regular milk feeding that contributes substantially to the labour inputs on a dairy farm. The feeding of milk and especially grain is necessary to develop the rumen of calves before weaning. Grain meal intake is used as an indirect estimator of rumen development and a criterion for weaning. It is believed that the specific milk feeding method has an effect on grain meal intake and rumen development of the calf. To ensure adequate development, a dry starter feed should be made available as soon as the calf receives milk or milk replacer. It has been reported that higher intakes of concentrates were observed in calves fed only once a day as compared to twice a day. The aim of the study was to evaluate the average daily concentrate intake (CI), average daily gain (ADG) and average feed conversion ratio (FCR) of Dexter x Holstein calves on two different milk feeding regimes. The CI and FCR were done on a group basis whereas ADG was done on an individual calf basis. All calculations were based on concentrate intake only since both groups received a fixed volume of 3 litres of milk/calf/day. A total of 40 calves were used and they were divided into once-a-day (OAD) (N=20) and twice-a-day (TAD) (N=20) groups. Calves were kept on Kikuyu pastures with ad lib. calf starter meal and fresh water available in a group fed scenario. All excess starter meal was weighed back on a daily basis and calves were weighed every fortnight. Calculations were done on a fortnightly basis, starting on week 2 and ending on week 10 at weaning. The OAD CI (kg) per calf per day for week 2, 4, 6, 8 and 10 was 0.097, 0.312, 0.370, 0.895 and 1.600 respectively. The TAD CI (kg) for week 2, 4, 6, 8 and 10 was 0.097, 0.285, 0.344, 0.852 and 1.600 respectively. The FCR for OAD during the same time period was 0.42, 0.78, 1.63, 1.15 and 1.70. The FCR for TAD was 0.29, 1.18, 1.79, 1.13 and 1.73. The ADG for OAD was 0.23, 0.34, 0.65, 0.78 and 0.94. The ADG for TAD was 0.31, 0.21, 0.59, 0.75 and 0.92 respectively. There were no significant differences (p ≥ 0.05) between OAD and TAD in any of the variables recorded. There was no negative effect on calves fed once-a-day only.

Keywords: once-a-day, twice-a-day, calf feeding, dairy, developing agriculture
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Introduction
The raising of dairy calves is an essential operation on any dairy farm. Dairy calves are essentially raised in order to have a steady supply of heifers. This steady supply of heifers is needed as replacement animals for culled cows. The culling/replacement rate is between 25 and 30 percent per annum in a normal dairy herd (Herdt, 1987). A substantial amount of time and effort is invested in feeding and looking after dairy cattle. However, the same does not always apply to the rearing of calves (Van Trierum, 2004). This is usually due to a lack of time and the correct discipline on a dairy farm (Van Trierum, 2004). When a dairy operation chooses to raise replacement heifers, additional feed, labour and facilities are needed. The raising of replacement heifers is an operation on its own and should almost be managed separate from the rest of the dairy activities and with the aim of preparing the heifer for production within 24 to 30 months (Thomas, 2014). The raising of calves and replacement heifers is the third most expensive operation on a dairy farm after labour and feeding cost of production animals (Olynk, 2010).

The most important aspect in calf rearing is to quickly develop the calf’s rumen in order to digest solid feeds and reduce its nutritional dependence on milk. Young (pre-ruminant) calves have a gastrointestinal tract similar to non-ruminants and they absorb nutrients via the intestine (Quigley & Bernard, 1992). Concentrated feeds are digested to propionic and butyric acids in the rumen and stimulate the growth of the rumen papillae. The digestion of milk and forages do not provide the end products needed to develop the rumen papillae (Heinrichs, 2005). Due to the fact that a calf can only consume a finite amount of dry matter, the addition of hay to the calf’s ration greatly decreases the intake of grain leading to a decrease in energy level from a total ration and a delay in ruminal function (Bailey, 1996). The substrate or diet provided to the young calf directly

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impacts the progress of rumen development. Forage digestion by micro-organisms does not provide sufficient concentration of volatile fatty acids (VFAs), especially butyrate which is required for optimal papillae development (Coverdale et al., 2004).

Commercial dairy breeds are notoriously difficult to maintain and require high dietary inputs for production and reproduction performance (Erasmus et al., 2002). All operations on a dairy farm are intensive and require a lot of time and labour hours. This may be one of the reasons why commercial dairy production units are not easily established in the emerging sector. It is of utmost importance to simplify operations on an emerging dairy farm as much as possible in order to allow the prospective farmer to ease into the production system. Simplifying the calf rearing system, which normally requires ±13% of labour time (Gleeson et al., 2007), is one measure to decrease labour and time on a dairy farm. The aim of this study was to investigate a simplified milk feeding regime for dairy type calves for potential use by commercial and especially emerging dairy farmers. The type of calves used in this experiment forms part of a breeding programme to develop a small frame, more easily maintained dairy cow for household and small-scale milk production in the developing agricultural sector. In this experiment, the effect of once day milk feeding on incidence of diarrhoea, concentrate intake (CI), average daily gain (ADG) and feed conversion ratio (FCR) from birth to ten weeks of age (weaning) was evaluated.

Materials and Methods

The experiment was conducted at the Döhne Agricultural Development Institute (27°29' E, 32°29' S). A total of Forty (40) Dexter x Holstein cross heifer and bull calves were used in the experiment. The calves were randomly divided into once-a-day (OAD) (N=20) and twice-a-day (TAD) (N=20) treatment groups four days after birth. The OAD group received three litres of milk once a day and the TAD group received a total of three litres in two equal parts, twice a day. The animals were kept on Kikuyu/Clover pastures with ad lib calf starter meal and water available in a group fed scenario from day 4 after birth until weaning at the end of week 10. All excess starter meal was weighed back daily and the live weight of the calves was recorded every fortnight. The following variables were recorded: group concentrate intake (CI) and individual average daily gain (ADG). Feed conversion ratio (FCR) was estimated on a group basis. Recordings for CI were done on a daily basis whereas, ADG and FCR were done on a fortnightly basis, starting on week 2 and ending on week 10. Mortalities as well as incidences of diarrhoea were also recorded. Data was analysed using the basic statistics and ANOVA modules of Statistica (2013). The CI was analysed as a cumulative group intake on a daily basis. The ADG was analysed per individual calf on a fortnightly basis. The FCR was analysed as means for the group on a fortnightly basis.

Results and Discussion

The result for daily CI is depicted in Figure 1. The OAD CI (kg) per calf per day for week 2, 4, 6, 8 and 10 was 0.097, 0.312, 0.370, 0.895 and 1.600 respectively. The TAD CI (kg) for week 2, 4, 6, 8 and 10 was 0.097, 0.285, 0.344, 0.852 and 1.600 respectively. The average CI for the OAD calves was similar or slightly higher than the TAD calves. No significant differences could be established between the two groups for CI when cumulative daily group intake was compared.

The result for ADG from week 2 to 10 is depicted in Figure 2. The ADG for OAD was 0.23, 0.34, 0.65, 0.78 and 0.94. The ADG for TAD was 0.31, 0.21, 0.59, 0.75 and 0.92 respectively. The ADG was higher for the TAD group at the end of week 2 only. Although not significant, the ADG for the OAD group appeared marginally higher from week 4 to week 10.

The result for FCR is depicted in Figure 3. It is important to note that the FCR was only calculated on the starter meal concentrate fed. The actual intake of forage from the pastures could not be measured and the milk portion of the diet was constant for both groups.

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The FCR for OAD during the experimental period was 0.42, 0.78, 1.63, 1.15 and 1.70. The FCR for TAD was 0.29, 1.18, 1.79, 1.13 and 1.73 respectively. The FCR appeared to be better in TAD at the end of week 2. In weeks 4, 6 and 10 the OAD group recorded a better FCR. The FCR at the end of week 8 was quite similar. An interesting observation was the fact that the FCR in both groups were markedly lower at the end of week 8. It can possibly point to the fact that the rumen starts to perform optimally during this stage of development. A similar trend was observed in an earlier production cycle where a group of Holstein calves underwent the same treatment. In this case a non-commercial mixed ration was fed and not a standard commercial starter meal as was the case in this study (own observation, unpublished data). There were no calf mortalities and the incidence of diarrhoea (1 per group) was similar in both groups during the experimental period.
The OAD calves appeared to perform marginally better than the TAD calves for all recorded variables. The observations for health (incidence of diarrhoea only), CI, ADG and FCR is consistent with those by Ackerman (1969); Burt (1968); Laird et al. (1969); Willet et al. (1969); Galton & Brakel (1976); Fallon (1999); and Stanley et al. (2002), who reported that feeding milk replacer once a day had no negative effect on health, weight gain and starter consumption of calves. Similar observations were reported when calves were fed once or twice a day with either cold whole milk (room temperature) (Gleeson, 2007) or warm whole milk (Owen et al., 1965). Randall & Swannack (1975) reported no difference between feeding once or twice a day of either warm or cold milk replacer. Contrary to this, it was reported by Perks et al., (1968), that calves fed once a day had higher live weights and consumed more starter meal than those fed twice a day in the pre-weaning phase which corresponds with the results obtained in the current study. White and Radcliffe (1970) reported that calves fed once a day had increased live weight during the pre-weaning phase but were again similar during the post-weaning phase. An interesting observation is the fact that both groups had a highly efficient FCR at the end of week 8 and this phenomenon warrants further investigation.

Conclusions
The once a day feeding of whole milk had no apparent negative effect on Dexter x Holstein calves. The OAD calves appeared to perform marginally better than the TAD calves. This method of feeding calves bodes well for potential once-a-day milking systems as it can be synchronized with the frequency of milking. It will also be a suitable husbandry practice for developing farmers as it will ease the pressure on labour costs and logistics.

References
Bailey, T.L., 1996. Feeding hay to young dairy calves is widely practised throughout Virginia and the U.S. Dairy pipeline (March).


